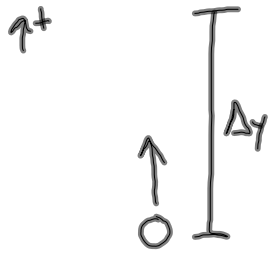
Kinematics:

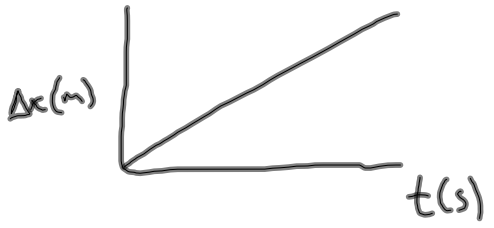
- Something in motion
- Variables: vector velocity (initial, final)
  vector acceleration
  vector displacement (x- and y- directions)
  scalar time
  scalar angle
- Vector: quantity with magnitude and direction
- Scalar: quantity with only magnitude (+/- means increase/decrease)
- Adding vectors: You cannot simply add them unless they are in the same direction. If they are in different directions, you have to use triangles
- Y-direction → throwing an object upward



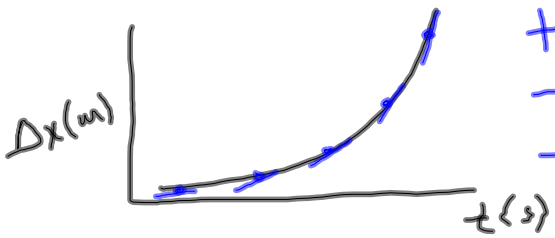
$a_g = -9.80\ m/s^2$

* this is a constant throughout the entire motion

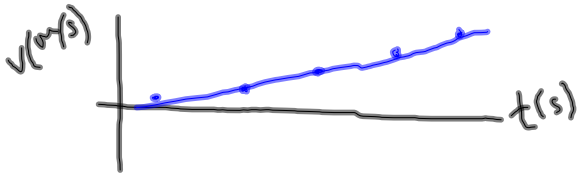
- Graphing:

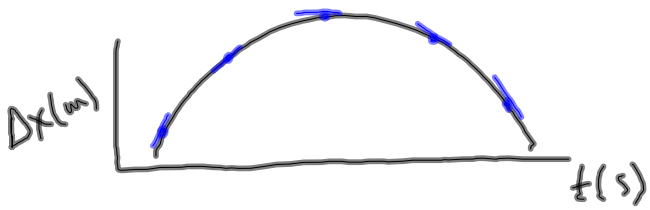


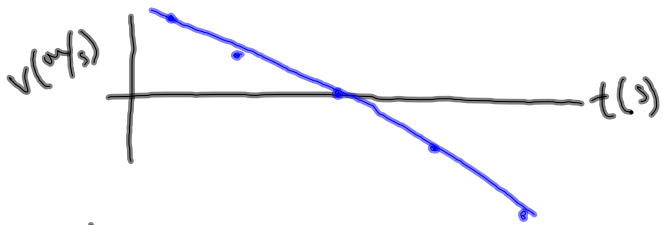
$$V = \frac{\Delta x}{\Delta t}$$

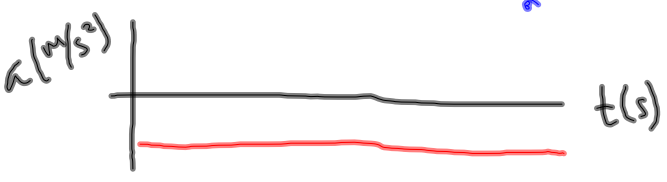


tangent lines
- look at slopes
- characterize as either positive or negative; high, low, or medium





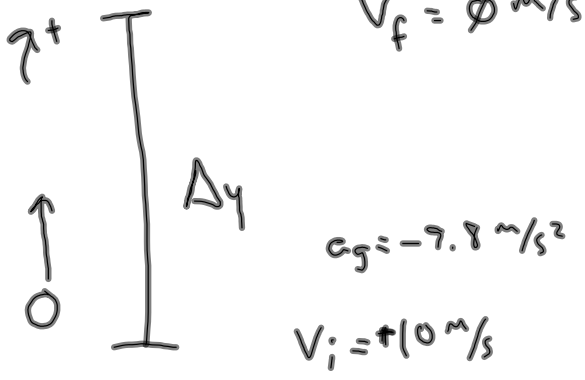




A person throws a ball upwards at 10 m/s.

a) How high does it travel?

b) How long does it take to reach the highest point?



a) $v_{fy}^2 = v_{iy}^2 + 2a_g\Delta y$

$$\Delta y = \frac{-v_{iy}^2}{2a_g}$$

$$= 5.10 \text{ m}$$

b) $v_{fy} = v_{iy} + a_g t$

$$t = \frac{-v_{iy}}{a_g}$$

$$= 1.02 \text{ s}$$

$$\Delta x = v_{ix}t + \frac{1}{2}a_x t^2$$

$$v_{fx} = v_{ix} + a_x t$$

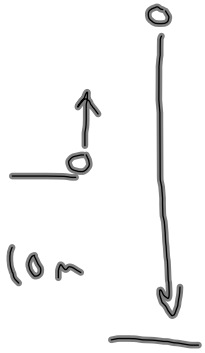
$$v_{fx}^2 = v_{ix}^2 + 2a_x \Delta x$$

$$\Delta y = v_{iy}t + \frac{1}{2}a_g t^2$$

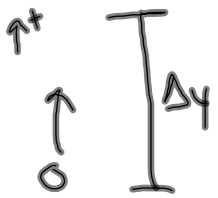
$$v_{fy} = v_{iy} + a_g t$$

$$v_{fy}^2 = v_{iy}^2 + 2a_g \Delta y$$

A person standing on a balcony at 10 m throws a ball upwards at a velocity of 8 m/s.
a) How high does the object go above the 10 m starting point?
b) How long does it take for the ball to hit the ground?



a)



$$\Delta y = \frac{-v_{iy}^2}{2a_g}$$

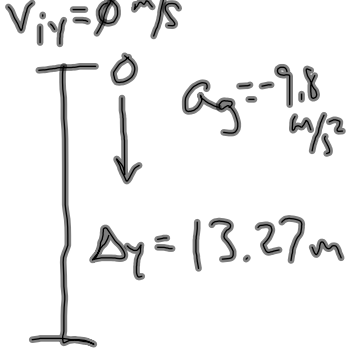
$$= 3.27\text{ m}$$

$$t_{up} = \frac{-v_{iy}}{a_g} = 0.816\text{ s}$$

b) total time $= t_{up} + t_{down}$

$= 0.816\text{ s} + 1.65\text{ s}$

$= 2.46\text{ s}$



$$\Delta y = v_{iy}t + \frac{1}{2}a_g t^2$$

$$t = \sqrt{\frac{2\Delta y}{a_g}}$$

$$= \sqrt{\frac{2(-13.27\text{ m})}{(-9.8\text{ m/s}^2)}}$$

$$= 1.65\text{ s}$$